

STATE OF ALASKA

Jay S. Hammond, Governor



Annual Performance Report for

A STUDY OF A TYPICAL
SPRING-FED STREAM
OF INTERIOR ALASKA

by

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations
of Alaska
Project No.: F-9-9
Study No.: G-III Study Title: LAKE AND STREAM INVESTIGATIONS
Job No.: G-III-G Job Title: A Study of a Typical Spring-Fed
Stream of Interior Alaska
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ABSTRACT

The Delta Clearwater River from Mile 17 to the mouth was sampled with an electrofishing boat to monitor existing stocks of Arctic grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas). Comparisons of relative abundance with like sampling in 1973 and 1975 are presented. The percent composition of grayling was highest in 1976, when they comprised 17.3% of the total sample. Age VI and V were the predominant age classes comprising 42% and 28% of the sample, respectively.

Fifty-eight anglers interviewed had a harvest rate of 0.42 grayling/hr. The mean length of 33 grayling sampled was 305 mm and age class V grayling comprised 49% of the sport fish catch.

Assessment was made of pond reared grayling stocked into spring areas of the Delta Clearwater River. Grayling fingerling were captured with a back-pack dc shocker in three of the four spring areas stocked in October, 1975. Thirty-two grayling sampled had a mean length of 111 mm and mean weight of 15.9 g. Circuli counts indicated that most of the grayling sampled in the spring areas were a result of the transplant of pond reared fish. An upstream movement of grayling less than 150 mm in length was noted in late April when 237 were captured in a fyke net at Mile One Slough.

Data pertaining to growth and survival of grayling fry stocked in three rearing ponds are presented. Approximately 3 months after stocking of grayling fry, fish in Left O.P. Pond had a mean length of 106 mm and a mean weight of 13.5 g. Survival of 25,000 fry stocked was estimated to be 34%. Population estimates indicated fyke nets fished for 3 days were effective in capturing 94% of the fingerling present. A total of 12,096 fingerling removed from two ponds was transplanted into spring areas and the Left Fork of the Delta Clearwater River.

Early spring fish movements into the Delta Clearwater River at Mile One Slough were monitored and methods of round whitefish capture were assessed.

Approximately one-third as many round whitefish were captured in a fyke net fished at Mile One Slough in 1976 as were captured in 1975, although visual observations indicated comparable numbers entering the river. A boat mounted shocker was used to capture 296 round whitefish in the upper Clearwater River.

BACKGROUND

The Delta Clearwater River is a spring-fed system located approximately 13 km (8 miles) northeast of Delta Junction. The main channel of the river is approximately 32 km (20 miles) in length and the north fork is about 10 km (6 miles) in length. The stream is characterized by relatively constant flows, levels and water temperatures. The river has a popular summer sport fishery for Arctic grayling, Thymallus arcticus (Pallas). Public access is available at the State of Alaska Clearwater Campground near Mile 9 of the river. A boat launching ramp provides riverboat access to the rest of the river.

Past work, going back to the United States Fish and Wildlife Service studies initiated in 1952, is described by Pearse (1976). Recent studies by Pearse (1974 and 1976) provided life history information regarding length frequencies and distribution, length-weight relationships, condition factors, age and sex composition, and maturity for Arctic grayling and round whitefish, Prosopium cylindraceum (Pallas). Estimates of abundance indicated 2,267 grayling and 13,611 round whitefish were present in 1973. As many as 5,000 silver salmon spawn annually in this system.

Work in 1975 and the present study deal with monitoring existing fish stocks and determining the feasibility and effects of round whitefish removal. Enhancement of the grayling population by transplanting pond reared grayling into spring areas of the Delta Clearwater is being evaluated.

RECOMMENDATIONS

1. Continue the index sampling of Arctic grayling and round whitefish in the Delta Clearwater River and expand the sampling to include a portion of the North Fork and Clearwater Lake outlet.
2. Expand the monitoring of sport fish harvest in the Delta Clearwater River and Clearwater Lake outlet.
3. Continue the experimental program of pond rearing and transplanting of Arctic grayling to the Delta Clearwater River.
4. Expand sampling efforts for assessing the results of the grayling transplants into spring areas and the North Fork of the Delta Clearwater River.

5. Continue the monitoring of early spring fish movement into the Delta Clearwater River and the removal of round whitefish.

OBJECTIVES

1. Monitor existing stocks of Arctic grayling and whitefish in the Delta Clearwater River.
2. Continue enhancement of grayling stocks in the Delta Clearwater River.
3. Determine the feasibility of controlling competition between grayling and round whitefish in the Delta Clearwater River.

TECHNIQUES USED

Fish population sampling to obtain estimates of relative abundance in the Delta Clearwater River was done by utilizing an alternating current boat mounted shocker described by Van Hulle (1968). Grayling and whitefish were captured during a single downstream run. At the end of each one-mile section, lengths and scale samples taken from all grayling and whitefish were counted. Both species were released within the section in which they were captured.

Spring areas previously stocked with pond reared grayling were sampled with a Coffelt back-pack dc shocker. Fish scales used for age determination were cleaned and mounted between glass slides, then read using a Bausch and Lomb microprojector. Fish were measured to fork length in millimeters and weight in grams.

Monthly samples of grayling in rearing ponds were collected using a 50' X 1/4" mesh bag seine. The fish were preserved in 10% Formalin with lengths, weights and scale samples collected at a later time.

Fall removal of grayling from rearing ponds was accomplished using fyke nets with 3/8" mesh. The fish were transported in a pickup-mounted stainless steel tank. Condition factors were determined by the formula $K = \text{weight} / \text{fork length}^3 \times 10^5$. Population estimates were made using the standard Petersen formula: $N = \text{number of fish marked and released} \times \text{number of fish examined for marks} / \text{number of marked recaptures}$.

Sampling at Mile One Slough utilized a New Hampshire style fyke net with a 50' X 3/8" mesh seine attached to one wing to block the slough.

FINDINGS

Monitoring of Arctic Grayling and Round Whitefish Stocks

The entire Delta Clearwater River from Mile 17 to the mouth was sampled with an electrofishing boat on June 29 and 30, 1976. All stunned Arctic grayling, Thymallus arcticus (Pallas), and round whitefish, Prosopium cylindraceum (Pallas), were dipnetted during a single downstream run through each one-mile section.

The relative abundance of grayling and whitefish captured as well as comparisons with like sampling in 1973 and 1975 (Pearse, 1974 and 1976) is presented in Table 1. The total capture rates for both grayling and whitefish were up from 1975, but lower than in 1973. The percent composition of grayling was highest in 1976, when they comprised 17.3% of the total sample compared to 14.0% in 1975 and 15.7% in 1973.

The relative abundance of grayling and whitefish has remained fairly consistent despite whitefish removal efforts in 1975 and 1976. A total of 1,200 round whitefish was removed in 1975, while 676 were removed in 1976. More data on the whitefish removal are presented in a following section.

The age composition and length-age relationship of 76 grayling, from a total of 85 taken during one sample run down the Delta Clearwater River in 1976, are presented in Table 2. Age VI was the predominant age class, comprising 42% of the total, followed by age class V with 28%. One fish aged at VIII was the oldest captured in 1976 and was 401 mm in length. Grayling of age class VI had a mean length of 326 mm. Mean lengths of other age classes for each of three sample years are also presented (Table 2).

Length frequency comparisons for grayling sampled in the Delta Clearwater River since 1973 are presented in Table 3. In 1973, 1975, and 1976, grayling from 265 to 364 mm accounted for 52%, 81%, and 73% of the total, respectively.

Fifty-eight anglers were contacted during the 1976 season to determine catch success as well as age and length composition of the grayling harvested. Anglers interviewed caught 52 grayling at a rate of 0.42 fish/hr. The mean length of 33 grayling sampled was 305 mm. This compares to a catch rate of 0.65 fish/hr (315 angler contacts) and a mean length for harvested grayling of 302 mm recorded in 1973 (Pearse, 1974).

Age composition of 33 grayling in the 1976 samples was as follows: III (3%), IV (18%), V(49%), VI (24%), and VII (6%).

Few anglers contacted had the current five grayling daily limit, although most of the contacts made represented incomplete trips. The census does not accurately depict the quality of fishery available. Fishermen who are familiar with the stream and are equipped with riverboats that provide greater accessibility, have a much higher catch rate.

Table 1. Relative capture rates per section for Arctic grayling and round whitefish during a single downstream pass with an electroshocker, Delta Clearwater River, 1973, 1975, 1976.

River Section	Grayling			Round Whitefish		
	6/27/73	7/2/75	6/30/76	5/18/73	7/2/75	6/30/76
17	25	36	9	48	142	2*
16	10	1	14	28	21	24
15	22	5	12	22	76	60
14	9	1	6	65	0	42
13	8	3	5	14	65	48
12	0	0	3	34	0	14
11	2	3	3	16	21	13
10	3	0	2	52	16	27
9	2	0	5	14	0	50
8	5	2	9	29	15	11
7	4	4	6	48	0	9
6	1	2	1	34	0	23
5	2	6	3	33	27	29
4	0	1	1	33	10	18
3	2	0	0	29	0	10
2	0	0	1	12	0	17
1	0	0	5	0	0	10
Totals	95	64	85	511	393	407
% comp. 1973	15.7			84.3		
% comp. 1975		14.0			86.0	
% comp. 1976			17.3			82.7

* 296 RWF were captured by boat shocker and removed in sections 17 and 16 on May 6 and 7, 1976.

Table 2. Length-age relationships of Arctic grayling electrofished in the Delta Clearwater River, 1976.

Fork Length (mm)	Age										
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
140-159		1									
160-179											
180-199			1								
200-219			2								
220-239			1	1							
240-259				3	1						
260-279				2	4						
280-299				3	5	5	1				
300-319					5	12					
320-339					4	5	1				
340-359				1	2	3	2				
360-379						5	2				
380-399						2	1				
400-419									1		
No. of Fish		1	4	10	21	32	7	1			
Age Composition %		1	5	13	28	42	9	1			

Table 3. Length frequency of Arctic grayling captured in the Delta Clearwater River, 1973-1976.

Length Class (mm)	1973 %	1975 %	1976 %
115-164	0.0	0.0	1.0
165-214	7.0	...	4.0
215-264	22.0	6.0	11.0
265-314	19.0	40.0	39.0
315-364	33.0	41.0	34.0
365-414	16.0	11.0	11.0
415-464	3.0	2.0	0.0
No. Fish	413	63	76

Grayling Stock Enhancement

Assessment of Grayling Transplanted in 1975:

Four spring tributaries of the Delta Clearwater River stocked in October, 1975, with pond reared grayling were sampled with a back-pack dc shocker during the first week of May, 1976. Grayling fingerling were captured in all but one of the springs. Lengths and weights of the sampled fish are presented in Table 4.

The 32 grayling sampled had a mean length of 111 mm and mean weight of 15.9 g. This compares to a mean length of 113 mm and a mean weight of 15.5 g from 15 fish sampled from the 9,100 pond-reared grayling transplanted into the four spring areas in October, 1975 (Pearse, 1976).

Circuli counts for 32 grayling sampled from the spring areas in early May, 1976, ranged from 11 to 15 with a mean of 13. A sample of 52 grayling from Delta Clearwater River in 1975 had an average circuli count of 8.7 to and including the first annulus; while pond reared grayling had an average circuli count of 14 on October 2, 1975 when they were transplanted to the Delta Clearwater River. The first-year circuli counts of a sample of 29 grayling (Age II-VIII) in 1976 ranged from 7 to 11 and averaged 8.8.

While the average circuli count of grayling sampled in spring areas in May, 1976, was one less than a sample of those planted in 1975, the count is considerably higher than that found to the first annulus of naturally occurring Delta Clearwater grayling both in 1975 and 1976. This would suggest that the grayling sampled in the spring areas were a result of the transplant of pond reared fish.

Two of the spring areas stocked and subsequently sampled are partially blocked by inactive beaver dams. The ponds were difficult to sample adequately with a back-pack shocker due to width, and an estimate of the total number of rearing grayling was not possible. However, the number of fish sampled, as shown in Table 4, represents about 30% or less of those actually observed in the portion of the spring-fed ponds that was sampled.

It is uncertain if grayling sampled in the spring areas in early May had overwintered there or elsewhere. An upstream movement was documented during fyke net sampling at Mile One Slough in late April. From April 24 to 27 and from April 30 to May 1, a total of 242 grayling having fork lengths less than 150 mm was captured. A sample of 10 of these fish was examined for circuli counts. The counts ranged from 9 to 14 and had a mean of 11.4. Four of the grayling had fewer than 11 circuli. Results are inconclusive, but suggest that about 40% of this sample were of natural origin or were the result of stocking 100,000 fry in the Delta Clearwater River both in 1974 and 1975. Larger grayling and whitefish are known to return to the Delta Clearwater River during this period, presumably from the Tanana River.

Table 4. Summary of length, weight and scale circuli counts from Arctic grayling sampled from spring areas of the Delta Clearwater River, May, 1976.

Location	Number	Length (mm)		Weight (g)		Circuli Counts	
		Range	\bar{x}	Range	\bar{x}	Range	\bar{x}
Spring #1	9	111-121	115	12.3-20.2	16.5	11-15	13.1
Spring #2	10	101-121	113	12.0-22.7	16.9	12-14	13.2
Spring #3	<u>13</u>	<u>88-124</u>	<u>107</u>	<u>7.7-21.1</u>	<u>14.6</u>	<u>11-15</u>	<u>13.2</u>
	32	88-124	111	7.7-22.7	15.9	11-15	13.2

Assessment of 1976 Pond Rearing:

As in 1975, three small natural lakes were stocked with grayling fry in late June, 1976. The lakes, ranging in size from 1.5 to 3.6 surface hectares (3.6 to 8.8 acres) and located on nearby Ft. Greely, were the same ones utilized in 1975. Other than surface areas which have been more accurately measured, physical and chemical characteristics are similar to those described in detail by Pearse (1976).

Pond #1 (East Pond) is approximately 2.8 surface hectares (6.8 acres) and has a maximum depth of 7 m (23'), making it the deepest of the stocked ponds. Grayling resulting from the 1975 plant of 25,000 fry were allowed to overwinter in the pond. During 3 days in mid May, 1976, a total of 3,500 grayling was removed with fyke nets and transplanted to Lost Lake near Quartz Lake. A sample of 15 grayling (unpreserved) had a length range of 85-105 mm and a mean of 99 mm while the weight ranged from 4.0 to 9.3 g with a mean of 8.2 g.

No estimate of the percent of removal was made; however, many fish were observed surface feeding following the removal.

On June 28, the pond was again stocked with 25,000 grayling fry. One month later three grayling captured by shoreline seining had a mean length of 55 mm and a mean weight of 5.1 g (Table 5). Growth was greater than in 1975 when grayling averaged 41 mm and 1.0 g after one month in the pond. The difficulty of capturing fish in this pond, however, compared to the other two ponds indicated poor survival of 1976 stocked fry, presumably due to competition from Age I grayling remaining in the pond from the 1975 fry plant. Due to the low survival, no further samples were obtained during 1976 from this pond.

Pond #2 (West Pond) is the largest of the rearing ponds with a surface area of 3.6 hectares (8.8 acres) and a maximum depth of 1.5 m (5'). The pond was also stocked with 25,000 grayling fry on June 28. First month growth in this pond also exceeded that recorded in 1975. Grayling sampled on July 28 had a mean length of 62 mm and a mean weight of 2.3 g compared to a mean length of 48 mm and a mean weight of 1.6 g in 1975. Lengths and weights recorded on August 28 and at time of removal on September 21 were less than recorded at comparable times in 1975. However, the calculated condition factor was slightly higher at time of removal in 1976 than it was in 1975 (Table 5). Total pond rearing time was 13 days less in 1976, as the fry were stocked 2 days later and the fingerling removed 11 days earlier than in 1975.

A single fyke net was set overnight on September 20, 1976 to capture fish for a mark and recapture population estimate. Approximately 1,600 fish were captured, 600 of which were fin clipped and returned to the pond. During the subsequent 3 days and nights, four fyke nets were set and an additional 3,212 grayling were captured. A total of 148 marked fish was found in the examination of 835 fish. Using the Petersen mark and recapture method of population estimation, an estimated 3,385 grayling remained in the pond after the initial removal of 1,000. This represents an estimated removal of 95%. The estimated total of 4,385

Table 5. Comparison of mean fork lengths, weights and condition factors of pond reared Arctic grayling*, 1975 and 1976.

Pond	Sample Date	1975				Sample Date	1976			
		N	\bar{x} Length (mm)	\bar{x} Weight (mm)	Condition Factor**		N	\bar{x} Length (mm)	\bar{x} Weight (mm)	Condition Factor
#1 (East Pond)	July 25	5	41	1.0	1.45	July 28	3	55	2.1	1.26
	Aug 28	5	75	5.2	1.24
#2 (West Pond)	July 25	5	48	1.6	1.45	July 28	18	62	2.3	0.96
	Aug 28	5	94	10.2	1.24	Aug 27	12	92	8.5	1.09
	Oct 2	5	108	12.9	1.02	Sept 21	11	96	9.6	1.08
Left O.P. Lake	July 25	5	51	2.1	1.58	July 28	21	63	3.1	1.23
	Aug 28	5	99	11.9	1.23	Aug 27	15	97	10.7	1.17
	Oct 2	10	115	16.8	1.10	Sept 22	11	106	13.5	1.13

* Each pond was stocked with 25,000 grayling fry. Stocking in 1975 occurred on June 26 and in 1976 on June 28.

** Condition Factor = $K = \frac{\text{Weight}}{\text{length}^3 \times 10^5}$

prior to removal provides a minimum survival of 18% of the initial 25,000 stocked fry. The 4,212 grayling removed had an averaged weight of 54/lb at the time of transplanting.

Left O.P. Lake is the smallest of the rearing ponds (1.5 hectares or 3.6 acres), less than one-half the size of Pond #2, although it is apparently the most fertile. The pond was stocked with an equal number of fry; however, the length, weight and condition factor was greater at each of the monthly samples than at Pond #2. The same was also true in 1975 (Table 5). At the time of removal, on September 22, 1976, the grayling had a mean length of 106 mm and mean weight of 13.5 g.

On September 20, a single seine haul captured 345 grayling which were fin clipped and released. Three fyke nets fished for 3 days and nights and resulted in the capture of 7,884 grayling weighing 36/lb. A total of 1,191 fish was examined, of which 49 were marked recaptures. The Petersen estimate for the number of fish in the pond prior to removal is 8,385. The removal effort represents an efficiency of 94% nearly identical to that for Pond #2. Estimated survival of the 25,000 stocked fry was 34%.

The 7,884 grayling removed from Left O.P. Lake were transplanted to the three lower spring areas on the Delta Clearwater River located in river sections 6-9, which were also stocked with pond reared grayling in 1975. Approximately equal numbers were stocked in each spring area. The water temperature in the spring areas was 4° to 5° C and 8°C in Left O.P. Lake on the date of the transplant.

The 4,212 grayling removed from Pond #2 were transplanted to the North Fork of the Delta Clearwater River. The fingerling grayling were transported by riverboat and released as far as 4 km (2.5 miles) into the North Fork. The water temperature was 4°C in the North Fork of the Delta Clearwater and 6°C in Pond #2 on the transplant date.

Circuli counts were made on a sample of 11 grayling from Left O.P. Lake and an equal number from Pond #2, for possible use in analysis of stream survival and separation from native grayling as described earlier. Circuli counts from grayling transplanted from Left O.P. Lake ranged from 12 to 14 and averaged 12.5. In Pond #2 the circuli count ranged from 10 to 13 with a mean of 11.4.

Round Whitefish Investigations

Estimates by Pearse (1974) indicated that round whitefish are six times more plentiful than grayling in the Delta Clearwater River. Although both species appear to be in good condition, competition for food and space may exist.

A continuing effort to monitor early spring movement into the Delta Clearwater River and to determine the feasibility of round whitefish removal was conducted in 1976. As in 1975, a fyke net was fished at Mile One Slough. This slough is a side channel of the Tanana River that enters the Delta Clearwater River at Mile One. It is fed by spring

upwelling during the months that the Tanana River is non-glacial. In April, many of the fish entering the Delta Clearwater River from the Tanana River move into Mile One Slough prior to further upstream movement. This is possibly due to the fact that One Mile Slough is typically several degrees warmer at that time of year.

Observations of fish movement began on April 14, at which time six round whitefish were observed in the Tanana River approximately 2 km below the Delta Clearwater River. On April 19 approximately 200 fish, mostly round whitefish, were observed from Mile 1 to 7. A fyke net was set at the Mouth of Mile One Slough on this date. A summary of fish captured during a 2 week period is presented in Table 6.

A total of 380 round whitefish was captured by fyke net during the period from April 2 to May 1 compared to the 1,200 captured in 2 days during 1975. The reason for the lower net catch in 1976 is uncertain, but may be related to water temperatures. The difference in temperature between the slough and the Delta Clearwater was less in 1976 than in 1975. Water temperature in the slough ranged from 4° to 8°C in 1976 and the Delta Clearwater River during the same period ranged from 3° to 7°C. The maximum temperature difference recorded on any day was 3°C.

In early May round whitefish were observed throughout the Delta Clearwater River. On May 6 and 7 a boat mounted shocker was utilized in the narrow portions of the upper Delta Clearwater River to determine the effectiveness of this tool for round whitefish capture. During the 2-day period a total of 296 round whitefish was captured in the section from Mile 15 to 17.

The effect of round whitefish removal during the past 2 years on the total population is difficult to assess at this time. In 1975 the entire Delta Clearwater River was sampled with a boat mounted shocker following the spring removal of whitefish. The total whitefish catch was considerably less than in 1973, as shown in Table 1. The total whitefish catch in 1976 was comparable to 1975, but the percent composition has decreased from 86.0% to 82.7%.

DISCUSSION

Population Analysis

The primary purpose of the current study is to monitor population levels of Arctic grayling and round whitefish to reveal population trends and for use in evaluating recent and ongoing grayling enhancement efforts. As reported in past studies, little grayling and whitefish reproduction occurs in this spring-fed system. With a general absence of grayling in age classes below Age IV in recent years, continued population monitoring through sampling of index areas and sport fish harvest should reveal if transplanting of pond reared grayling is contributing to year class strength of these age groups.

Table 6. Summary of fish captured at Mile One Slough, April 20-May 1, 1976

Date	Number Fish Captured						Misc.
	RWF		GR		SS	LCI	
	<150 mm	>150 mm	<150 mm	>150 mm			
4/20	1	7	5	16	...
4/21	...	60	...	16	12	10	3 SSC, 1 HWF
4/22	...	105	...	29	6	18	...
4/23	...	57	...	28	6	5	1 HWF
4/24	...	76	58	42	11	30	1 HWF, 3 BB
4/25	...	18	...	6	...	10	1 HWF
4/27	3	24	118	12	114	298	7 BB
5/1	4	33	61	26	169	55	3 SSC, 5 BB, 2 HWF
Totals	8	380	242	159	318	442	

* Fish Species

- RWF - round whitefish, Coregonus cylindraceum (Pallas)
 GR - grayling, Thymallus arcticus (Pallas)
 SS - silver salmon, Oncorhynchus kisutch (Walbaum)
 LCI - least cisco, Coregonus sardinella (Valenciennes)
 SSC - slimy sculpin, Cottus cognatus Richardson
 HWF - humpback whitefish, Coregonus pidschian (Gmelin)
 BB - burbot, Lota lota (Linnaeus)

Sampling results during the past two seasons show a small increase in relative abundance of grayling. Whether this is due to removal of round whitefish during early spring movement in 1975 and 1976 or a result of natural fluctuation is unknown at this time.

Grayling Stock Enhancement

The practice of utilizing small natural lakes for grayling rearing is providing a suitable number (approximately 10,000 annually) of healthy fingerlings for enhancement studies. Stocked as fry in late June and removed as fingerlings after approximately 3 months of pond rearing, the fish exceed the back calculated length at Age I of grayling found in the Delta Clearwater River. The project requires relatively little time and expense. Survival from the stocked fry has ranged from 18% to 34%, and about 94% of the resulting fingerlings were removed with fyke nets in 3 days and stocked into spring areas of the Delta Clearwater River.

If these grayling remain or become imprinted and return to the Delta Clearwater system, they could contribute significantly to the fishery. Sampling results to date suggest a return of stocked fingerling although the percentage return is difficult to assess at this time.

Round Whitefish Investigations

Round whitefish are six time more plentiful than grayling in the Delta Clearwater River according to estimates made in 1973. Sport utilization is minimal and efforts to develop a sport fishery may have been unsuccessful.

The goal of grayling population enhancement through stocking of pond reared grayling fingerling is believed to have greater potential for success if combined with a reduction in whitefish numbers to lessen competition for food and space. Spring whitefish removal during 1975 and 1976 has resulted in the reduction of numbers by approximately 1,900 whitefish. Continued reductions by fyke netting or reopening of the spring subsistence fishery to the public would be desirable.

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